

### **REMARKS**

In view of the Office Action of May 23, 2005, claims 1-12 stand rejected. Claims 1-10 are pending in this application, whereas claims 11 and 12 have been cancelled. Claims 13-20 have further been added which define some specific dimensions and structures of the multiple embodiments of the claimed invention.

Claims 1-4 stand rejected under 35 USC §103(a) as being unpatentable over Liu et al. (U.S. Patent No. 6,513,476) in view of Zhu et al (6,182,630). Claims 5-10 further stand rejected over this combination in further view of Paro (5,553,585). The office action states that Liu has been relied upon to show all structure, most notably the acute re-entrant angle. The office action further states that Zhu et al is merely relied upon to show that large diameter pistons are known in the art.

As discussed in Applicants' Amendment of February 22, 2005, it is longstanding practice in the art of diesel engine engineering to provide diesel engines having piston diameters of more than 180 mm with an obtuse re-entrant angle of the crown bowl sidewall. Nevertheless, as discussed in Applicants' specification and as shown in prior art, an acute re-entrant angle has not been used in prior art diesel engine pistons having a diameter of over 180mm. (*See paragraph 10 of Applicants' Specification*).

As discussed in Applicants' specification, small-bore and medium-bore, high speed engines as described in Liu are subjected to lower mechanical and thermal loads when compared to large-bore, medium speed diesel engines. The acute re-entrant design allows for air swirl motion and fuel spray jet impingement to help cool the piston and minimize the higher thermal stresses on the rim. These prior art small-bore and medium-

bore, high speed engines include pistons of less than 180mm and may, therefore, utilize acute re-entrant angles.

Acute re-entrant designs as described in Liu are not generally scalable to pistons for large-bore, medium speed diesel engines. For large-bore, medium speed diesel engines, there is generally no air swirl, and fuel spray jets generally do not impinge on the bowl. Instead, for large-bore, medium speed diesel engine pistons, a recess is generally defined below the piston squish face and in relation to the bowl sidewall in order to cool the piston. Small-bore and medium-bore, high speed engines as described in Liu do not have these recesses, and are therefore not scalable for large-bore, medium speed diesel engine applications. Accordingly, in essence, the prior art teaches away from Applicants' claimed invention.

In order to clarify such, independent claims 1 and 3 have been amended to include a recess defined below the piston squish face and in relation to the bowl sidewall. Accordingly, it is reiterated that an artisan skilled in the art would need inventive inspiration to disregard his/her experience and oppositely reconstruct the piston of either Liu or Zhu so as to apply an acute re-entrant angle sidewall to a diesel engine piston having a diameter of over 180mm and a recess generally defined below the piston squish face and in relation to the bowl sidewall.

In yet another structural difference, none of the prior references show a crown bowl further including a substantially frustoconical inner surface bounded within the bowl sidewall and about the centerline. More specifically, as shown in the cross-sections of the multiple embodiments of the present invention, the bowl inner wall (e.g., W in Applicants' Figures) is substantially linear. When rotating this substantially linear inner

wall about the centerline, a substantially frustoconical inner surface is formed. In contrast, the cross-sections of the inner walls of Liu as shown in Figure 1 and Zhu as shown in Figure 3 are generally curved. When rotated about their respective centerlines, the prior art inner walls form a generally hemispherical or semi-circular (*not* frustoconical) inner surface. Dependent claims 19 and 20 have been added to claim such.

Accordingly, Applicants respectfully request withdrawal of the 103(a) rejections. In view of the foregoing, reconsideration and allowance of all claims are respectfully requested. The Examiner is invited to telephone the Applicants' undersigned attorney at (312) 236-8500 if any unresolved matters remain. The Commissioner is further authorized to charge any applicable fees for filing this amendment to deposit Account No. 50-1039.

Respectfully submitted,  
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